Non-Nuclear Science Programs at the 88-Inch Cyclotron: Part B. Biology, Physics, and New Technologies *

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Small amounts of beam time at the 88-Inch Cyclotron are dedicated to non-nuclear science programs in radiation biology, high-energy physics, and materials.

Radiobiology

With the closure of the Bevalac in 1993, part of the Life Science Division's work in radiobiology moved to the Cyclotron. A beamline was developed for light ions tuned with uniformities of ±10% over diameters of 10 cm. Dose, flux, and uniformity are measured with a segmented ion chamber.

Radiation biologists study the effect of radiation on living tissue from microscopic systems (DNA strands) through macroscopic ones (cataract studies).

One of several radiation biology studies being pursued at the 88-Inch Cyclotron has already made discoveries which may change future textbooks on structural biology. By studying the size distribution of DNA fragments after passage of heavy ions through a cell†, shown in Figure 1, and comparing these with Monte Carlo calculations‡, one can differentiate between various models for the structure of the DNA inside the nucleus, These studies show that the generally accepted model is most likely not correct.

High Energy Physics

The irradiation station and diagnostics developed for the biology program have proven to be of direct use to members of the Physics Division involved with the Atlas Detector being designed for the LHC at CERN. Protons from the 88-Inch Cyclotron are used to perform radiation damage studies on silicon diodes being considered for use in Atlas.

Materials Studies

The discovery of "nuclear tracking" in the late 1950's led to a new class of nuclear physics detectors as well as a wide range of practical applications. Variations of the nuclear tracking technique have been pursued at the Cyclotron, for example, in the i) calibration of nuclear track detectors for physics experiments, ii) exploration of new techniques to make micropore filters, and iii) development of flat screen displays for lap-top computers. These kinds of studies require the ability to accelerator a variety of heavy, low-energy beams with good uniformity. A scintillating fiber/CCD detector is under development for tuning and dosimetry of these beams.

Footnotes and References

* Condensed from Proceedings of the International Symposium on Large-Scale Collective Motion of Atomic Nuclei, Brolo, IT, October 1996, to be published.

†Bjorn Rydberg, Rad. Res. **145,** 200 (1996).

‡W.R. Holley and A. Chatterjee, Rad. Res. **145**, 188 (1996).

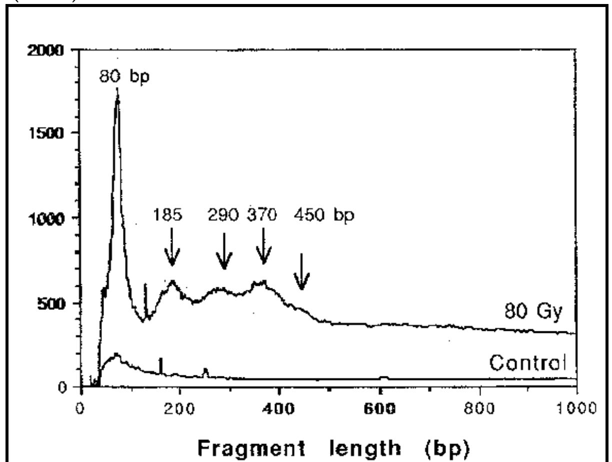

Fig. 1. Experimental distribution of DNA fragments after bombardment by 32.5 MeV/u N ions.